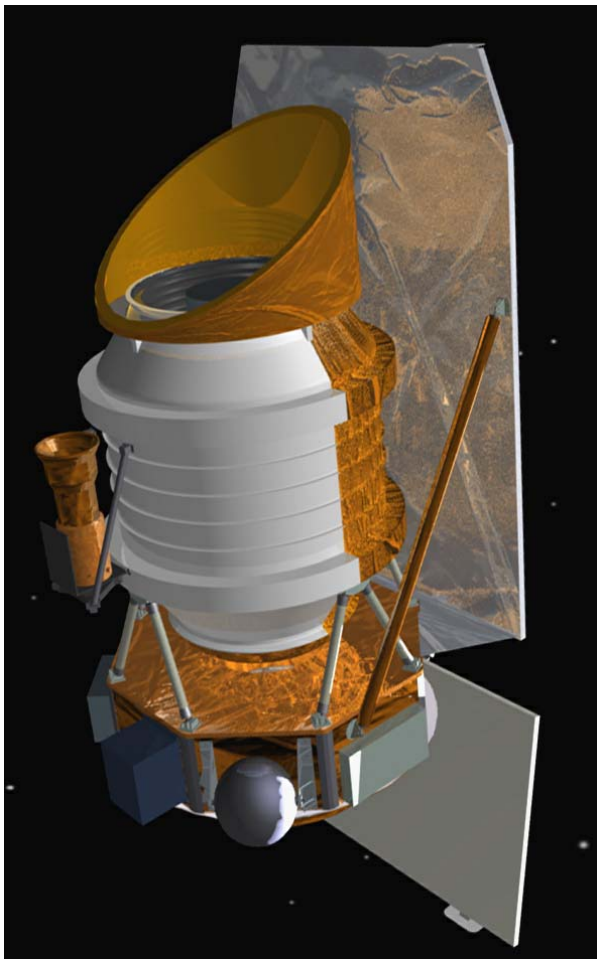
The AstroBiology Explorer (ABE) Mission. S. A. Sandford, NASA-Ames Research Center, Astrophysics Branch, Mail Stop 245-6, Moffett Field, CA 94035 USA (Scott.Sandford@nasa.gov)

Introduction: Infrared spectroscopy in the 2.5-16 micron range is a principle means by which organic compounds can be detected and identified in space via their vibrational transitions. Ground-based, airborne, and spaceborne IR spectral studies have already demonstrated that a significant fraction of the carbon in the interstellar medium (ISM) resides in the form of complex organic molecular species [1]. Furthermore, the presence of D-enriched organics in meteorites suggests that a portion of these materials survives incorporation into protosolar nebulae [2,3]. Unfortunately, neither the distribution of these materials in space nor their genetic and evolutionary relationships with each other or their environments are currently well understood.

The Astrobiology Explorer (ABE) is a MIDEX mission concept designed to use infrared spectroscopy to address outstanding problems in Astrochemistry which are particularly relevant to Astrobiology and are amenable to astronomical observation. ABE is currently under study at NASA's Ames Research Center in collaboration with Ball Aerospace and Technologies Corporation and the Jet Propulsion Laboratory [4-6]. ABE was selected for Phase A study during the last MIDEX AO round, but has yet to be selected for flight.

ABE's Science Goals: The principal scientific goal of ABE is to detect and identify organic materials in space, ascertain their abundance and distribution, and determine the processes by which they are formed, altered, and destroyed. The core program would make fundamental scientific progress in understanding (1) the chemical evolution of organic molecules in the ISM as they transition from stellar AGB outflows to planetary nebulae to the diffuse ISM to HII regions and dense clouds, (2) the distribution of organics in the diffuse ISM, (3) the evolution of ices and organic matter in dense molecular clouds and forming stellar systems (4) the nature of organics in the Solar System (with an emphasis on comets and asteroids), and (5) the nature and distribution of organics in a wide variety of galaxies. In addition, ABE will attempt to detect and quantify deuterium enrichments in a select set of these materials and environments in order to assist with understanding the chemical processes that occur in these environments and to establish any links that exist between interstellar and meteoritic organics.

Fundamental progress can be made in all of these areas by conducting a coordinated set of infrared spectroscopic observations of approximately 1000 galaxies, stars, planetary nebulae, and young star / planetary systems. These observations require a sensitive observatory above the Earth's atmosphere. There are currently no other existing or planned facilities which have given adequate scientific priority to such observations and which could complete our observing program within their mission lifetimes. A dedicated mission would allow us to optimize mission design to obtain the best data possible for the investigation.



ABE Design: The ABE Observatory consists of a simple spacecraft based on previous Ball designs mounted to a cooled 60 cm diameter space telescope equipped with 3 cross-dispersed spectrometers that share a single common slit. The telescope itself is cooled passively to T < 55 K. Each spectrometer measures one spectral octave and together cover the entire 2.5-20 micron region simultaneously. Spectral

resolution of the instrument is wavelength dependent but $\lambda/\Delta\lambda > 2000$ at all wavelengths of coverage. The spectrometers use state-of-the-art InSb and Si:As 1024x1024 pixel detectors. Critical optics and the detectors are cooled by solid hydrogen cryogens. ABE would operate in a heliocentric, Earth drift-away orbit and have a core science mission lasting ~1.2 years

ABE at a Glance

Telescope Diameter	60 cm
Orbit	Heliocentric-driftaway
Cryogenic Lifetime	~40 months
Telescope Temperature	< 55 K
Pointing Stability	2.5-3.0" rms
Wavelength Range	2.5-5.1 µm and 4.9-16 µm
Spectral Resolution ($\lambda/\Delta\lambda$)	2000-3000
Detector Array Size	1024 x 1024 pixels
Detector Array Types	InSb and Si:As

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